MINISTRY OF WATER AND IRRIGATION

WATER RESOURCE POLICY SUPPORT

Water Reuse Component

Information Management:
Data Migration of Water Quality Data from WAJ and RSS to MWI WIS

June, 2001

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List of Abbreviations

AZB	Amman-Zarqa Basin
BOD	Biological Oxygen Demand
COD	Chemical Oxygen Demand
MG/L	milligrams per litre
MWI	Ministry of Water and Irrigation
LIMS	Laboratory Information Management System
RSS	Royal Scientific Society
TDS	Total Dissolved Solids
WAJ	Water Authority of Jordan
WIS	Water Information System of MWI

EXECUTIVE SUMMARY

The initial work carried out in November 2000 (MWI/ARD, 2000) identified further work needed to resolve the various constraints imposed on the data migration process, including the migration of water quality data from WAJ and RSS to the Water Information System of the Ministry of Water and Irrigation. This led to the current assignment by the Chemist/Database Consultant to progress this task under Activity 4.7 Water reuse monitoring and information management.

The main task of this work was to carry out an assessment of the inconsistencies in the procedures, units of measurement and comparison of the standard methods of analysis between WAJ, RSS and the parameter and analytical codes held in the Ministry of Water & Irrigation (MWI) Water Information System (WIS). As the data contained in WIS was used by MWI for national policy and planning strategies these inconsistencies must be resolved to allow reliable, accurate and verifiable data to be regularly migrated to WIS.

Detailed comparison of the standard methods used by the WAJ labs and RSS with the pertinent parameter codes from MWI WIS has helped to clarify and resolve the constraints in the data migration process. Appendix 4 shows the detailed list of comparisons. Results from the collation, comparison and analysis of the list, including interviews with key informants from WAJ, RSS and MWI WIS, indicated the following:

- Majority of the analyses originate from the AWWA standard methods book on Water and Wastewater (Eaton A., Clesceri L., and Greenberg A., 2000).
- Comparison of analytical methodologies for various parameters shows that either they are the same standard test methods or, if different methods are used, they produce comparable results.
- The original units of measurements used in the analysis procedure are dependent upon the requirements of the Client. However chemical constituents may be re-calculated to any unit measurement. For example, nitrogen compounds can be represented in MG /L as N or NO_3 or NH_4 or NO_2.
- For analysis of trace/heavy metals from relatively low turbidity water samples, usually from potable supply, WAJ and RSS do not normally include digestion as part of the analytical procedure, but it is assumed that $Metal_{total} \cong Metal_{dissolved}$.
- Analysis methods will change as new editions of the book of standard methods are updated, and better and possibly more practical test methods/instruments are developed, or less toxic chemicals are used in the procedure. These must be reflected in the data migration procedure.
- Validation of standard methods used for analyses of water quality parameters is beyond the scope of MWI staff, therefore, it must be the responsibility of the laboratories to ensure the standard methods are validated with MWI parameter code and proper analytical methods in current use at that time.

- The analytical methods currently coded and held in WIS are more general and consists of the type of instrument used in the analysis or the name of the methodology rather than the test number of the actual standard method.

Currently the only water quality data that have been transferred to MWI WIS are the analysis of spring and groundwater samples taken by the MWI monitoring unit. Water quality data from monitoring of reservoirs, treatment plants and other surface monitoring points have not been transferred. This has been partially due to the fact that WIS does not have station IDs for these sites. These data are held by WAJ labs and RSS in their own electronic databases, and summary analysis reports based on these data are submitted to WAJ and MWI on a monthly and annual basis.

Originally it was expected that WAJ labs would be able to transfer their data sets using their Laboratory Information Management System (LIMS) as both databases are Oracle. However LIMS is not fully operational and all historic water quality data is still stored in other databases. It is expected, as a short to medium term measure, for current data held by WAJ Labs and RSS to be downloaded onto spreadsheet files as a simply and easy means for data transfer between database systems. These files can be easily used by all the collaborative organizations and can provide means for verification of this by using formulas for built-in error checking both in terms of mistakes made in the actual values inputted to the spreadsheets and analysis error estimates using ionic balance calculations. For the historic data, an assessment on the best way to migrate these data will need to be conducted before the data can be transferred.

Based on the results described above, recommendations for further work to strengthen data migration and information management between the corroborative organisations and MWI are listed below.

- It is recommended that a case study be conducted to determine the gaps in the data migration procedures from WAJ to MWI. This case study will be sued to formalize data migration procedures.

- Continue development of a spreadsheet template to allow migration of data from all collaborative organisations.

- An assessment of the historic data held in electronic form by WAJ Labs should assess the feasibility for migration into LIMS and MWI WIS. This will include liaison with the WAJ IT specialist for LIMS in respect to data structure, validation, import and export.

1. BACKGROUND

The work completed by ARD short term Database Specialist, Andrew Alspach and assisted by Ramzi Sabella (Water Reuse Engineer-ARD) on the task component for water reuse monitoring and information management were reviewed (MWI/ARD, 2000).

Discussions were held with Ramzi Sabella about the background to the previous work on information management in respect to data migration from WAJ and RSS to the MWI Water Information System (WIS). This included standardisation of parameter coding with methodology. MWI WIS database has a list of about 700 parameter codes shown in Appendix 3. Each parameter code consists of a chemical constituent or analyte. It may include indication of the methodology, original sample media, and the units of measurement. For chemical constituents, such as nitrates, alkalinity and phosphates, the unit can be calculated according to the compound or element. An example for nitrogen is shown in Table 1extracted from the MWI Parametercode_unit.xls 14.11.00 file.

Table 1: Sample of MWI WIS Parameter Coding

Parameter Code	Chemical Constituents and units calculated according to type of chemical constituent or analyte	Indication of Methodology	Original Sample Media	Unit Of Measurement
71845	Nitrogen, Ammonia - Total as NH4		Water	MG as NH_4 / L
610	Nitrogen, Ammonia - Total as N		Water	Mg as N / L
640	Nitrogen, Inorganic - Total		Water	MG as N /L
625	Nitrogen, Kjeldahl – Total	Kjeldahl	Water	MG as N /L
627	Nitrogen, Kjeldahl – Total	Kjeldahl	Sediment-Dry	MG as N /KG
621	Nitrogen, Nitrate		Sediment-Dry	MG as NO_3 /KG
620	Nitrogen, Nitrate - Total as N		Water	MG as N /L

Confirmation was received on 6 May by Edward Qunqur, Director of the Water Resources Directorate, to allow the Consultant to access the pertinent information from the WIS database through the Oracle Database Administrator, Ms. Ibtisam Saleh and to conduct interviews/discussion within MWI and collaborative organisations in respect to data migration issues and information management. Interviews were held with WAJ labs, RSS and WIS personnel at MWI (Appendix 2).

Based on these discussions and visits, a detailed review and comparison of standard methods of each laboratory was conducted to define the constraints to the data migration process to MWI WIS.

2. WATER QUALITY DATA MIGRATION

2.1. Current Status

Currently the only water quality data that has been transferred to MWI WIS are the analysis of spring and groundwater samples taken by the MWI monitoring unit. Water quality data in respect to monitoring of reservoirs, treatment plants and other surface monitoring points have not been done partially due to the fact that WIS do not have station IDs for these sites. These data are held by WAJ labs and RSS in their own electronic databases and summary analysis reports based on these data are submitted to WAJ and MWI on a monthly and annual basis.

To migrate data from the WAJ labs and RSS and to establish the formalisation procedures understanding of the types of water quality data available and the decision on the validity and importance of having these data sets transferred to the MWI WIS is necessary. Water quality data an be divided into the types outlined below:

- Water quality data from analysis of groundwater and spring samples taken by the MWI monitoring unit
- Water quality data from monitoring by WAJ and JVA submitted as analysis reports on monthly and yearly basis to WAJ and JVA by WAJ labs and RSS.
- Historic water quality data held by WAJ Labs from 1989-2001
- Historic water quality data held by other organisations such as Ministry of Health, Ministry of Agriculture and treatment plants.

The expectation from MWI was that WAJ would be able to transfer their data sets using LIMS as both databases uses Oracle. However LIMS is not fully operational and as an interim measure current data held by WAJ Labs have been transferred to MWI using spreadsheets. To date only the water quality data from groundwater and springs taken by MWI monitoring unit have been transferred to MWI mostly on an ad hoc informal basis. No other water quality data has been transferred to the MWI WIS.

2.2. Comparison of Parameter Codes and Standard Methods

WAJ laboratory list of standard methods with drinking water and waste water constituents and analytes were original obtained from the WAJ September 2000 monthly report. These methods were based on Standard Methods 19th Edition. These were updated to 20th Edition using the list from WAJ annual report for the year 2000. The list of standard methods also uses the 20th Edition Standard metho ds were obtained from the Royal Scientific Society (RSS). These methods were used to compare the MWI parameter codes and analytical test methods of the laboratories of WAJ and RSS. MWI WIS has an extensive list of 700 parameters codes for water and soil and covers all inorganic major

and minor ions, heavy/trace metals, physical parameters, organics including pesticides and herbicides, biological and microbiological constituents, and aggregate properties for wastewater such as COD and BOD. The comparison list is shown in Appendix 4.

Analysis of the list with the information obtained from interviews with the key informants concluded the following:

- Majority of the analyses originate from the AWWA standard methods book on Water and Wastewater (Eaton A., Clesceri L., and Greenberg A., 2000).
- Comparison of analytical methodologies for various parameters shows that either they are the same standard test methods or if different methods are used they produce comparable results.
- The original units of measurements used in the analysis procedure is dependent upon the requirements of the Client however chemical constituents may be re-calculated to any unit measurement. For example nitrogen compounds can be represented in MG /L as N or NO_3 or NH_4 or NO_2.
- For analysis of trace/heavy metals from relatively low turbidity water samples usually from potable supply WAJ and RSS do not normally include digestion as part of the analytical procedure but it is assumed that $Metal_{total} \cong Metal_{dissolved}$.
- Analysis methods will change as new editions of the book of standard methods are updated and better and possibly more practical test methods/instruments are developed or less toxic chemicals are used in the procedure and this must be reflected in the data migration procedure.
- Validation of standard methods used for analyses of water quality parameters is beyond the scope of MWI staff therefore it must the responsibility of the laboratories to ensure the standard methods are validated with MWI parameter code and proper analytical methods in current use at that time.
- The analytical methods currently coded and held in WIS is more generalise and consists of the type of instrument used in the analysis or the name of the methodology rather than the test number of the actual standard method.

2.3. The Way Forward

The mechanisms and procedures to allow trouble free data transfer has not been developed for any of the collaborative organisations. Existing methods at the WAJ Labs for data transfer relies on informal contacts. These procedures allow a great deal of uncertainty in the validity of the data and the scheduling of the transfer is at the whim of these operators. With the expectation that WAJ Labs will apply for ISO certification and laboratory accreditation the constraints to data migration must be resolved and the process must also be formalised.

It is clear that the responsibility of setting the parameter code and analytical code for input by MWI must come from the laboratory providing the results of the analyses. MWI staff do

not have the chemistry background to independently classify the coding. For the WAJ labs it has been assumed that once LIMS is fully operational then transfer of water quality data would be simplified as they are using the same operational database, Oracle. For the short and medium term a method has been devised to allow data migration in electronic form from all corroborative organisations. To fully understand the constraints to data migration and facilitate the transfer of data from the WAJ Labs and RSS to MWI a case study should be conducted at the WAJ labs using the existing standard excel template produced by Andrew, Alpach, ARD database specialist (MWI/ARD, 2000). Modification to this file should look at the following parameters:

- Verification of input data by using for built-in formulas for error checking both in terms of errors made in the actual values put into the spreadsheet to analysis error estimates using ionic balance.
- MWI Station ID
- Units of Measurement are clearly shown with type name of chemical constituent if appropriate
- MWI Parameter Code
- Analytical method

Migration of historical data from other organisations is outside the terms of reference of this study. However, the mechanisms and procedures to be developed for WAJ and RSS data should be considered in light of migration of data to MWI from other collaborative organisations.

3. RECOMMENDATIONS

Ideally all water quality data from JVA and WAJ should be migrated to the MWI WIS. This would mean that the system of transfer should become automated as much as practical to minimise transfer errors and staff requirements. The procedures in data migration must be formalised as a matter of priority to establish the authority for a clear directive for data migration from WAJ labs and RSS.

Based on the results in section 2.2 and 2.3, recommendations for further work to strengthen data migration and information management between the collaborative organisations and MWI are listed below.

- It is recommended that a case study be conducted to determine the gaps in the data migration procedures from WAJ to MWI. The results from the case study should be used to develop the methods to correctly formalise the data migration procedures.

- Continue development of a spreadsheet template to allow migration of data from all collaborative organisations.

- An assessment of the historical data held in electronic form by WAJ Labs, and assessment of the feasibility of migration into LIMS and MWI WIS. This will include liaison with the WAJ IT specialist for LIMS in respect to data structure, validation, import and export.

REFERENCES

Eaton A., Clesceri L., and Greenberg A., eds., (2000) Standard Methods for the Examination of Water and Wastewater, 20th edition American Public Health Association, Washington DC

MWI/ARD (2000). Monitoring & Information Management Pertaining to Water Reuse in Jordan, MWI, Amman Jordan.

USAID/SAIC (1999). Water Quality Conservation and Improvement Project, MWI, Amman Jordan.

USAID/DAI (1998) Water Quality Improvement and Conservation Project, Water Information System (WIS) Databases User's Guide, Volume II, MWI, Amman.

USAID/DAI (1998) Water Quality Improvement and Conservation Project, Water Information System (WIS) Databases Design Update Document, MWI, Amman.

APPENDIX 1

SCOPE OF WORK
CHEMIST / DATABASE SPECIALIST

Scope of Work-Jordan Water Resource Policy Support Project
Short Term Technical Assistance- Chemist / Database Specialist
Extension of time on existing Scope of work for Mr. Howard Wong 1005

Background

Following the consultant's initial review of the Ministry data entry system, it has been determined that the data migration process is constrained by current mechanisms used in the transfer of data and data entry procedures. This includes standardisation of parameters in respect to units of measurement, location and ID coding, reliability, accuracy and verification of transferred data sets. The short-term specialist on database/water chemistry will work with the Ministry personnel to update these aspects of the procedures, which will facilitate the future migration of water quality data to MWI from WAJ and RSS. This has necessitated an extension of the effort on the SOW from 10 to 25 workdays.

This project is to support the implementation of Jordan's water policies, and one of its main components is wastewater reuse planning. Advancements have been made in identifying water quality data from collaborative organizations and the short term inputs from a specialist in chemistry and database structures are needed to continue these efforts.

The consultant's current assignment is to continue efforts to migrate water quality data to the Ministry's database. The consultant is familiar with water quality parameters for wastewater and Standard International Methods used to analyse this data. In addition he has knowledge of Oracle database structures and coding.

Scope of Work

The Consultant will assess current water quality parameter and Standard Method coding in the MWI database for RSS data. A comparison of this coding to identify data sources will be conducted and new codes will be created when needed.

The intent of this Consultant's input is to complete the work detailed under activity 4.7 (Monitoring and Information Management), which is focused on enhancing the Ministry's capability to gather, access and utilize the data and information relevant to water reuse (RSS data).

The activity specifically requires the following:

1. Review documentation and work to date by ARD/MWI staff pertaining to data migration.

2. Update parameter codes based on Royal Scientific Society (RSS) and Jordanian Water Authority (WAJ) water quality parameters while reviewing MWI existing coding to insure there is no duplication of codes.

3. Update Standard Method codes based on Royal Scientific Society (RSS) and Jordanian Water Authority (WAJ) water quality parameters while reviewing MWI existing coding to insure there is no duplication of codes.

This work is to be integrated with the other activities under this component, and with the relevant activities of the Groundwater component.

Outputs

- A table of new parameter codes to be added to MWI database.
- Justification document for new water quality parameter codes
- A table of new Standard Method codes to be added to MWI database.
- Justification document for new water quality Standard Method codes

Roles and Responsibilities

The consultant will report to ARD's Chief of Party on all logistical issues, and work directly with the Water Reuse Planning Component leader on all technical issues.

Level of Effort

Level of effort to be extended from 10 days to 25 days, to complete the activities outlined in this scope of work.

Schedule

As soon as possible, continuing the work until early-June.

APPENDIX 2

MEETING/DISCUSSION NOTES

MEETING/DISCUSSION NOTES

MWI PERSONNEL FOR 6 MAY 01

With Ms. Ibtisam Saleh, Oracle Database Administrator

General overview of the status of data transfer was given and the source of WIS structure is from USAID/DAI (1998) Water Quality Improvement and Conservation Project, Water Information System (WIS) Databases User's Guide, Volume II, MWI, Amman. No new parameter codes nor analytical methods have been added since the report.

Since final list of coding was not established USAID/ARD 2000 then no data from WAJ and RSS was being put in manually into MWI database.

From Mr. Ayman Jabr, Geologist/WIS data entry, MWI
(8 May 01)

The only water quality data inputted into WIS is from groundwater and springs only from the analysis of samples taken specifically by the MWI monitoring unit. The transfer of data is based on a common methodology tied into the parameter code. There are about 10-15 of these currently used. From late 1997 to current the data is manually inputted by Ayman Jabr from data sent from WAJ LABS of springs and groundwater only on disk as an excel file. Recently they have thought to email this file as an attachment. The data does not show error checking of the analysis i.e. ionic, TDS or EC balances. Ayman has to check that these data are in the correct units then if not to convert them before entry into the WIS. In addition the lab uses their own sample ID no (this is inconsistent sometime the MWI station ID is there sometimes not). Ideally the lab should show both the lab and WIS station ID but Ayman does not put in the lab sample ID and leaves this section blank. The excel files are given to the MWI from WAJ labs in an informal manner as these transfers are based on personal relationships. As the MWI field technician must go to the WAJ labs to submit the water samples they arranged informally to pickup the data on disk when it is ready. The WAJ labs do not have a formal structure and schedule in which to give the data to MWI so the transfer of data is at the discretion of lab personnel.

These samples of springs and groundwater are taken by MWI directly by their technicians and these samples are labelled according to WIS station ID, Name of well, date, time, These are repeated on a standard form from WAJ labs and includes purpose and type of analyses needed for the sample. WAJ labs may sample these locations as well but this data is not transferred to MWI WIS. In addition WAJ labs takes samples of wastewater from industry and treatment plants and these data are not transferred to MWI WIS.

In the contents section Ayman only refers to the biological constituents The lab put in the upper limit value even when it is greater than the upper detection limit. i.e. coliform, L > detection limit, K < detection limit.

Questions to WAJ LABS

Discussion with Dr. Nawal Sunna (10 May 2001)

What isn't the WIS station ID included as output of the data transfer file
At the moment this field can not easily be extracted from the FoxPro database. The IT specialist provided by USAID/ARD will look at resolving some of the problems with data transfer to MWI personnel. The IT specialist was involved with EU funded project on a EXACT project with donors from USAID, CIDA AND EU looking at water quality data.

The LIMS system will be able to integrated the MWI sample ID with the WAJ lab no. The IT specialist also look at export of data from LIMS to WIS.

Currently there is no formal procedure to transfer data to MWI WIS. At the moment WAJ Labs is working on good faith to transfer data to MWI WIS on an informal basis. The data transferred is only the data from the analysis of water samples taken by MWI technicians. The formalisation process should be outlined from the MWI with the requirements for the data transfer and given to the collaborative organisations.

No other water quality data has been transferred to MWI partially due to the fact that the monitoring sites for reservoirs, distribution systems, pumping station and wastewater monitoring sites don't have Station ID no. from MWI WIS..

Samer M. is the person working in the IT section of the labs should be interview for the IT component of data transfer. Currently the WIS station ID can not be export into excel sheets.

IONIC BALANCE NEEDED IN THE SPREADSHEET. Not currently incorporated into Foxpro but calculated separately prior to import of the data to FoxPro.

UNITS NEEDED ACCORDING TO WIS DATABASE. The units has now been resolved but the unit fields currently can not be extracted from FoxPro

Highlights of discussion with RSS LABS Dr. Saidam, Head of Water Studies Division

RSS has obtained accreditation and certification outlined below.

Formulation, documentation, implementation and evaluation of quality systems for technical laboratories in accordance with EN45001 ,ISO/IEC Guide 25, ISO 9000 and similar standards requirements. Technical assessment of testing and calibration laboratories according to EN45001, ISO/IEC Guide 25, ISO 9000 elements.

The list of standard test methods were given as a hard copy to the Consultant. Since RSS is acting as a private contractor to WAJ and JVA the production of data transfer files can be according to any structure the Client wishes. Therefore transfer of data on spreadsheets using the MWI Station ID and any other criteria would be abiding by the requirements of the Client.

Discussions with Hala Zuwati (IT Specialist)

Integration of data transfer from the current foxpro database should be a priority until the LIMS systems is in actual operation. This mean that a standardised excel proforma should be designed that would allow validation of the data using the parameter codes and station ID from MWI including all appropriate unit measurements. For the moment emphasise should be on the water samples taken by the MWI technicians however this proforma should be used eventually for all water quality data including wastewater held by WAJ labs and RSS labs. This work should be largely completed by the Chemist/database Consultant with help from the IT specialist (Hala) and WAJ lab IT database personnel.

APPENDIX 3

LIST OF MWI PARAMETER CODES

APPENDIX 4

COMPARATIVE LIST OF WAJ AND RSS STANDARD METHOD AND MWI PARAMETER CODE

Analysis	Symbol	Method Used	Method No. and Ref.		Parameter Codes for Water Quality Data WIS			
			WAJ LABS Units not given	RSS	MWI			
Alkalinity		*Titration* *Total Alkalinity pH 4.3-4.9 use bromocresol green or methyl red mixture* *Phenolphthalein alkinity pH 8.3 use phenolphalein indicator*	*Standard Method 20th edition2320 B*	*Standard Method 20th edition 2320 B*	410	Alkalinity, T (as CaCO3, M. Orange)	Water	MG/L
					431	Alkalinity, T (as CaCO3, M. Orange) - Field	Water	MG/L
Aluminum	**Al**	*Inductively Coupled Plasma*	*Standard Method 20th edition3120 B*	*Standard Method 20th edition 3111 B AA Spectrometric Method*	1105	Aluminum - Total	Water	UG/L
					1106	Aluminum - Dissolved	Water	UG/L
					1108	Aluminum	Sediment-Dry	MG/KG
Ammonia	**NH_4^+**	*Ammonia Selective Electrode Method*	*Standard Method 20th edition 4500 NH_3 D*	*Standard Method- (20^{th} ed.) 4500-NH_3 C Standard Method (18^{th} ed.) 4500-NH_3 C*	71845	Nitrogen, Ammonia - Total as NH4	Water	MG/L
					610	Nitrogen, Ammonia - Total as N	Water	MG/L
Ammonia (Waste water)	**NH_4^+**	*Nesslerization Method (this method dropped as SM in 20^{th} Ed. due to use of mercury)*	*Standard Method 17 th edition 4500 NH_3*	*Standard Method- (20^{th} ed.) 4500-NH_3 C Standard Method (18^{th} ed.) 4500-NH_3 C*	610	Nitrogen, Ammonia - Total as N	Water	MG/L
Anionic Surfactants	**MBAS**	*Colorimetric Method*	*Standard Method 19 th edition 5540 C*	*Standard Method 15 th edition 5540 C*	38260	MBAS (methylene blue active subts.) (detergents)	Water	MG/L
Anionic ***surfactants*** AS	**ABS**	*Kit Method*	-					
Anionic surfactants AS (Waste Water)	**ABS**	*MBAS*	*Standard Method 20th edition 5540 C*					

Notes: **Abbreviations:** **SM** **Standard Methods** **IPC** **Inductively Coupled Plasma**

For trace/heavy metals for samples with relatively low turbidity the samples are not digested and it is assumed that Metal $_{total} \cong$ Metal $_{dissolved}$

The unit of measurement decided in respect to determination of concentrations in the analysis and compilation of the results is dependent upon the requirements of the Client.

Unless there is specific requirements from the Client WAJ Labs the unit of measurement for inorganics and analytes is MG/L and coplex organics such as pesticides in UG/L

Highlighted parameter codes are the recommended units of measurement for data migration

Analysis	Symbol	Method Used	Method No. and Ref.		Parameter Codes for Water Quality Data WIS			
			WAJ LABS Units not given	RSS	MWI			
Arsenic	**As**	*Inductively Coupled PlasmaOntinuous Hydride Generation/Atomic Absorption Spectrometric*	*Standard Method 20th edition 3120 B 3114 C*	*Standard Method 20th edition 3114 C (AA Spectrometric Method)*	1000	Arsenic - Dissolved	Water	UG/L
					1002	Arsenic - Total	Water	UG/L
					1003	Arsenic	Sediment-Dry	MG/KG
Barium	**Ba**	*Inductively Coupled Plasma*	*Standard Method 20th edition 3120 B*		1005	Barium - Dissolved	Water	UG/L
					1007	Barium - Total	Water	UG/L
						Barium	Sediment-Dry	MG/KG
Bicarbonate (Waste water)	**HCO_3^-**	*Titration Method Total Alkalinity pH 4.3-4.9 use bromocresol green or methyl red mixture Phenolphthalein alkinity pH 8.3 use phenolphalein indicator*	*Standard Method 20th edition 2320 B*	*Standard Method 20th edition 2320 B*	440	Bicarbonate as HCO3 (Lab)	Water	MG/L
					450	Bicarbonate as HCO3 (Field)	Water	MG/l
Bio Chemical Oxygen Demand (BOD_i) Waste water	**$B.O.D_5$**	*5 day BOD test*	*Standard Method 20th edition 5210 B*	*Standard Method 20th edition 5210 B iodometric titration*	310	BOD - 5 day (20 Deg, C)	Water	MG/L
Boron	**B^{+3}**	*Carmine Method det limit 2 ug B Curcumin Method det lim 0,2 ug B*	*Standard Method 20th edition 4500 B, C*		1020	Boron - Dissolved	Water	UG/L
					1022	Boron - Total	Water	UG/L
					1023	Boron	Sediment-Dry	MG/KG
Boron (Waste Water)	**B^{+3}**	*Inductively Coupled Plasma*	*Standard Method 20th edition 3120 B*	*Standard Method 15 th edition 4500 B D IPC*	1020	Boron - Dissolved	Water	UG/L
					1022	Boron - Total	Water	UG/L
					1023	Boron	Sediment-Dry	MG/KG

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Highlighted parameter codes are the recommended units of measurement for data migration

Analysis	Symbol	Method Used	Method No. and Ref.		Parameter Codes for Water Quality Data WIS			
			WAJ LABS Units not given	RSS	MWI			
Bromide	**Br-**	*Ion Chromatography with Chemical Suppression of Eluent Conductivity*	*Standard Method 20th edition 4110 B*	*Standard Method 20th edition 4110 B*	71870	Bromide (as Br)	Water	MG/L
Cadmium	**Cd**	*Inductively Coupled PlasmaElectrothermal Atomic Absorption Method*	*Standard Method 20th edition **3120 B** 3113 B*	*Standard Method 20th edition **3111 B** (AA spectrometric Method)*	1025	Cadmium - Dissolved	Water	UG/L
					1027	Cadmium - Total	Water	UG/L
					1028	Cadmium	Sediment-Dry	MG/KG
Calcium	**Ca^{++}**	*EDTA Titrimetric Method*	*Standard Method 20th edition 3500 Ca B*	*Standard Method 20th edition 3111 B AA Spectrometric Method*	915	Calcium - Dissolved	Water	MG/L
					916	Calcium - Total	Water	MG/L
					917	Calcium	Sediment-Dry	MG/KG
					910	Calcium as CaCO3	Water	MG/L
Calcium Carbonate		*Titration*	*Standard Method 20th edition 2330*	*Standard Method 20th edition 2330 C as total Hardness*	910	Calcium as CaCO3	Water	MG/L
Carbon Dioxide	**CO_2**	*Calculation Method*	*Standard Method 20th edition 4500 CO_2 C*	*Standard Method 20th edition 4500 CO_2 C*	405	Carbon Dioxide	Water	MG/L
Carbonate	**$CO_3^{=}$**	*Titration Method*	*Standard Method 20th edition 2320 B*	*Standard Method 20th edition 2320 B*	445	Carbonate ion (as CO3)	Water	MG/L
					447	Carbonate ion (as CO3) (Field)	Water	MG/L
					452	Carbonate ion - Dissolved as CO3 (Field)	Water	MG/L
Chemical Oxygen Demand (Waste Water)	**C.O.D**	*Closed Reflux Titrimetric Method*	*Standard Method 20th edition 5220 C*	*Standard Method 20th edition 5220 B Open Reflux*	340	COD - 0.25N K2CR2O7	Water	MG/L
					339	COD	Sediment-Dry	MG/KG
Chloride	**Cl^-**	*Ion Chromatography with Chemical Suppression of Eluent Conductivity*	*Standard Method 20th edition 4110 B*	*Standard Method 20th edition 4500 Cl D*	940	Chloride - Total	Water	MG/L
					941	Chloride - Dissolved	Water	MG/L
Chloride (Waste Water)	**Cl^-**	*Argentometric Method*	*Standard Method 20th edition 4500 Cl^- B*	*Standard Method 20th edition 4500 Cl D*	940	Chloride - Total	Water	MG/L
					94	Chloride - Dissolved	Wate	MG/L

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Analysis	Symbol	Method Used	Method No. and Ref.		Parameter Codes for Water Quality Data WIS			
			WAJ LABS Units not given	RSS	MWI			
Chlorine	Cl_2		*Chlorine Comparator Unit Needs To Be Clarified From Waj Labs*	*Standard Method 20th edition 4500 Cl G residual free chlorine*	50060	Chlorine - Total Residual	Water	MG/L
					50064	Chlorine - Free Available	Water	MG/L
					50066	Chlorine - Combined Available	Water	MG/L
					365	Chlorine demand - 15 minute	Water	MG/L
Chromium	**Cr**	*Inductively Coupled Plasma* *Electrothermal Atomic Absorption Method*	*Standard Method 20th edition* ***3120 B*** *3113 B*	*Standard Method 20th edition 3111 B AA Spectrometric Method*	1029	Chromium	Sediment-Dry	MG/KG
					1030	Chromium - Dissolved	Water	UG/L
					1034	Chromium - Total	Water	UG/L
					1032	Chromium, hexavalent	Water	UG/L
					1220	Chromium, hexavalent - Dissolved	Water	UG/L
					1033	Chromium, trivalent	Water	UG/L
Cobalt **0.2 –10 ug/l in water, can form complex ions**	**Co**	*Inductively Coupled Plasma* *Direct Air-Acetylene Flame*	*Standard Method 20th edition* ***3120 B*** *3111 B*	*Standard Method 20th edition 3111 B AA Spectrometric Method*	1035	Cobalt - Dissolved	Water	UG/L
					1037	Cobalt - Total	Water	UG/L
					1038	Cobalt	Sediment-Dry	MG/KG
Copper **0.1 –12 ug/l in water, can form complex ions**	**Cu**	*Inductively Coupled Plasma* ***Direct Air-Acetylene Flame***	*Standard Method 20th edition 3120 B 3111 B*	*Standard Method 20th edition 3111 B AA Spectrometric Method*	1040	Copper - Dissolved	Water	UG/L
					1042	Copper - Total	Water	UG/L
					1043	Copper	Sediment-Dry	MG/KG
Cyanide	CN^-	*Colorimetric Method* *Requires distillation before analysis and Total CN^- is obtained*	*Standard Method 20th edition 4500 CN- E Confirm unit of measurement with WAJ LABS*	*Standard Method 20th edition 4500 CN^- F Distillation & Cyanide selective electrode 0.05-10mg (Total CN^-)*	720	Cyanide - Total as CN	Water	MG/L
					721	Cyanide	Sediment-Dry	MG/KG
					723	Cyanide - Dissolved (Std Method)	Water	UG/L
Cyanide (Waste Water)	CN^-	*DP-Stripping Voltammetric Polarography*	- *Confirm unit of urement with WAJ LABS*	*Standard Method 20th edition 4500 CN^- F Distillation & Cyanide selective electrode 0.05-10mg (Total CN^-)*	720	Cyanide - Total as CN	Water	MG/L
					721	Cyanide	Sediment-Dry	MG/KG
					723	Cyanide - Dissolved (Std Method)	Water	UG/L

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Analysis	Symbol	Method Used	Method No. and Ref.		Parameter Codes for Water Quality Data WIS			
			WAJ LABS Units not given	RSS	MWI			
Dissolved Oxygen (Waste Water)	**D.O**	*Titroprocessor, D.O Meter*	*Standard Method 20th edition 4500-0*	*Standard Method 20th edition 4500-0 C titration 4500-0 G*	299	Dissolved Oxygen (by probe) (MG/L)	Water	MG/L
Electrical Conductivity	**EC**	*Instrumental Measuremen In Laboratory*	*Standard Method 20th edition 2510 B*	*Standard Method 20th edition 2510 B EC meter*	95	Conductivity (umhos/cm @ 25C)	Water	UMHOS/ CM
					94	Conductivity (Field)	Water	UMHOS/ CM
Fixed & Volatile Solids (Waste Water)	**F & V.S**	*Ignited at 550 C° The residual is total fixed solids and weight loss is the total fixed volatiles*	*Standard Method 20th edition 2540 E*	*Standard Method 20th edition 2540 E*	500	Residue - Total	Water	MG/L
					510	Residue - Total Fixed	Water	MG/L
					515	Residue - Total Filtrable	Water	MG/L
					520	Residue - Volatile Filtrable	Water	MG/L
					525	Residue - Fixed Filtrable	Water	MG/L
					530	Residue - Total Nonfiltrable	Water	MG/L
					540	Residue - Fixed Nonfiltrable	Water	MG/L
					545	Residue - Settleable (ml/L)	Water	ML/L
					546	Residue - Settleable (mg/L)	Water	MG/L
					547	Residue - Total Nonsettleable (mg/L)	Water	MG/L
					548	Residue - Fixed Nonsettleable (mg/L)	Water	MG/L
					549	Residue - Volatile Nonsettleable (mg/L)	Water	MG/L
					70294	Residue - Total Dissolved (Calculated)	Water	MG/L
					70295	Residue - Total Filtrable (dried at any temperature)	Water	MG/L
					70300	Residue - Total Filtrable (dried at 180 C)	Water	MG/L
					82548	Residue - Nonvolatile, Nonfilterable	Water	MG/L
					82549	Residue - Total Nonvolatile	Water	MG/L
					505	Residue - Total Volatile	Water	MG/L
					535	Residue - Volatile Nonfiltrable	Water	MG/L

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			WAJ LABS Units not given	RSS	MWI			
Fluoride	**F^-**	*Ion Chromatography with Chemical Suppression of Eluent Conductivity*	*Standard Method 20th edition 4110 F B*	*Standard Method 20th edition 4500 F⁻ C*	950	Fluoride - Dissolved as F	Water	MG/L
					951	Fluoride - Total as F	Water	MG/L
Hardness	**$[Ca^{++}+Mg^{++}]$**	*EDTA Titrimetric Method* Total Hardness defined as sum of Ca and Mg concentrations as mg $CaCO_3$ / l	*Standard Method 20th edition 2340 C*	*Standard Method 20th edition 2340 C*	901	Hardness, carbonate (as CaCO3)	Water	MG/L
Hardness (Waste Water)	**$[Ca^{++}+Mg^{++}]$**	*EDTA Titration*	*Standard Method 20th edition 2340 C*	*Standard Method 20th edition 2340 C*	901	Hardness, carbonate (as CaCO3)	Water	MG/L
Heavy Metals (Waste Water)	**Zn, Mn, Fe, Ni, Pb, Cr, Cd, Cu**	*Direct Air – Acetylene Method*	*Standard Method 20th edition 3111 C &3130 B*	*Standard Method 20th edition 3111 B AA Spectrometric Method*	**REFER TO SPECIFIC METAL**			
Hydroxide	**OH^-**	*Titration Method pH endpoint dependent*	*Standard Method 20th edition 2320 B*		71830	Hydroxyl ion (Hydroxide ion)	Water	MG/L
Iron **0.1 –10 mg/l in water**	**Fe**	*Inductively Coupled Plasma*	*Standard Method 20th edition **3120 B** 3111 B*	*Standard Method 20th edition 3111 B AA Spectrometric Method*	1047	Iron (Ferrous)	Water	UG/L
					1045	Iron - Total (ug/l)	Water	UG/L
					1046	Iron - Dissolved	Water	UG/L
		Direct Air-Acetylene Flame			1170	Iron	Sediment-Dry	MG/KG
Kjeldahl Nitrogen	**KN**	Macro-Kjeldahl Method Sum of organic N & ammonia	*Standard Method 20th edition 4500 Norg B*	*Standard Method 20th edition 4500 Norg B*	625	Nitrogen, Kjeldahl - Total	Water	MG/L
					627	Nitrogen, Kjeldahl - Total	Sediment-Dry	MG/KG
Lead **3 ug/l to <0.1 mg/l in water**	**Pb**	*Inductively Coupled Plasma electroothermal Atomic Absorption Spectrometric*	*Standard Method 20th edition 3120 B 3113 B*	*Standard Method 20th edition 3111 B AA Spectrometric Method*	1049	Lead - Dissolved	Water	UG/L
					1051	Lead - Total	Water	UG/L
					1052	Lead	Sediment-Dry	MG/KG

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			WAJ LABS Units not given	RSS	MWI			
Lithium **3 ug/l to <0.1 mg/l in water**	**Li^{+}**	*Flame Emission Photometric Method Inductively Coupled Plasma*	*Standard Method 20th edition 3500 Li B 3120*	*Standard Method 20th edition 3111 B AA Spectrometric Method*	1130	Lithium - Dissolved	Water	UG/L
					1132	Lithium - Total	Water	UG/L
Magnesium Streams about 4 mg/l Groundwater > 4 mg/l	**Mg^{++}**	*Calculation Method Mg hardness is difference between total Hardness and Calcium hardness as* mg $CaCO_3$ / l *Mg hardness can be converted to mg Mg/l Mg* mg $CaCO_3$ / l*0.243	*Standard Method 20th edition 3500 Mg E*	*Standard Method 20th edition 3111 B AA Spectrometric Method*	920	Magnesium (as CaCO3)	Water	MG/L
					924	Magnesium	Sediment-Dry	MG/KG
					925	Magnesium - Dissolved (mg/l)	Water	MG/L
					927	Magnesium - Total (mg/l)	Water	MG/L
					82033	Magnesium - Total (ug/l)	Water	UG/L
					82037	Magnesium - Dissolved (ug/l)	Water	UG/L
Manganese Streams about 7 ug/l Groundwater <1 mg/l	**Mn**	*Inductively Coupled Plasma* *Direct Air-Acetylene Flame*	*Standard Method 20th edition 3120 B 3111 B*	*Standard Method 20th edition 3111 B AA Spectrometric Method*	1053	Manganese	Sediment-Dry	MG/KG
					1055	Manganese - Total	Water	UG/L
					1056	Manganese - Dissolved	Water	UG/L
Molybdenum Streams about 1 ug/l Groundwater < 0.1 mg/l	**Mo**	*Inductively Coupled Plasma*	*Standard Method 20th edition 3120 B*	*Standard Method 20th edition 3111 B AA Spectrometric Method*	1060	Molybdenum - Dissolved	Water	UG/L
					1062	Molybdenum - Total	Water	UG/L
					1063	Molybdenum	Sediment-Dry	MG/KG
Nickel Streams about 1 ug/l Groundwater < 0.1 mg/l	**Ni**	*Inductively Coupled Plasma* *Electrothermal Atomic Absorption Spectrometric*	*Standard Method 20th edition 3120 B 3113 B*	*Standard Method 20th edition 3111 B AA Spectrometric Method*	1065	Nickel- Dissolved	Water	UG/L
					1067	Nickel - Total	Water	UG/L
					1068	Nickel	Sediment-Dry	MG/KG

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			WAJ LABS Units not given	RSS	MWI			
Nitrate	NO_3^-	*Ultraviolet Spectrophotometric Screening Method(clear low nitrate water) or Ion Chromatography with Chemical Suppression of Eluent Conductivity*	*Standard Method 20th edition 4500 NO_3 B 4110 B* *Check with MWI to standardise the unit of measurement*	*Standard Method 20th edition 4110 B*	621	Nitrogen, Nitrate	Sediment-Dry	MG/KG
					620	Nitrogen, Nitrate - Total as N	Water	MG/L
					71850	Nitrogen, Nitrate - Total as NO_3	Water	MG/L
Nitrate (Waste Water)	NO_3^-	*Brucine Method* *This method not listed in 20 Ed. And may be deleted*	*Standard Method 14 th edition 4500 NO_3 B* *Check with MWI to standardise the unit of measurement*	*Standard Method 20th edition 4110 B*	621	Nitrogen, Nitrate	Sediment-Dry	MG/KG
					620	Nitrogen, Nitrate - Total as N	Water	MG/L
					71850	Nitrogen, Nitrate - Total as NO_3	Water	MG/L
Nitrite	NO_2^-	*Ion Chromatography with Chemical Suppression of Eluent Conductivity*	*Standard Method 20th edition 4110 B* *Check with MWI to standardise the unit of measurement*	*Standard Method 20th edition 4500 NO_2 B Colorimetric Method*	71855	Nitrogen, Nitrite - Total as NO_2	Water	MG/L
					615	Nitrogen, Nitrite - Total as N	Water	MG/L
					630	Nitrogen, Nitrite plus Nitrate - Total as N	Water	MG/L
Odor		*Threshold Odor Test*	*Standard Method 20th edition 2150 B*		***No listing of units or methodology***			
Oil and Grease		*Partition-Gravimetric Method*	*Standard Method 20th edition 5520 B*	*Standard Method 20th edition 5520 B*	556	Oil and Grease (Freon Ext., Grav Method)	Water	MG/L
					557	Oil and Grease (Freon Ext., Grav Method)	Sediment-Dry	MG/KG
Organo- Chlorinated Pesticides **Subtantial list of compounds from MWI and listed at end of table**	**OCP**	*Gas Chromatographic Method*	*Standard Method 20th edition 6630 B*	DFG S19 + cleanup Method 6 Pesticides in Soil / Vegetables				
pH	**pH**	*Electrometric Method*	*Standard Method 20th edition 4500 H^+ B*	*Standard Method 20th edition 4500 H^+ B*	400	pH	Water	SU
					403	pH - Lab	Water	SU
					406	pH - Field	Water	SU

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			WAJ LABS Units not given	RSS	MWI			
Phenols		*Liquid-liquid extraction Gas Chromatographic Method*	*Standard Method 20th edition 6420 B*	***Standard Method 20th edition*** ***5530 C*** *Total by colorimetry*	34694	Phenol - Total	Water	UG/L
					34695	Phenol	Sediment-Dry	UG/KG
					32731	Phenols	Sediment-Dry	MG/KG
					46002	Phenols - Direct Photometric (no distillation)	Water	UG/L
Phosphate – Total (Waste Water)	**TP**	*Persulphate Digestion Method for conversion of all P species to orthophosphate then a colorimetric method is used to find concentrarton of TP*	*Standard Method 20th edition 4500 P.B 4500 P D* *Check with MWI to standardise the unit of measurement*	*Standard Method 20th edition 4500 P.C 4500 P D*	650	Phosphate - Total as PO4	Water	MG/L
					665	Phosphorus - Total as P	Water	MG/L
					668	Phosphorus - Total Sediment as P	Sediment-Dry	MG/KG
Phosphate (Waste Water)	**PO_4^{-3}**	*Stannous Chloride Method 0.01-6 mg/l as P*	*Standard Method 20th edition 4500 P D* *Check with MWI to standardise the unit of measurement*	*Standard Method 20th edition 4500 P C Vanadomolybd-ophosphoric acid 1-20 mg/l as P*	650	Phosphate - Total as PO4	Water	MG/L
					665	Phosphorus - Total as P	Water	MG/L
Phosphorus	**P**	*Stannous Chloride Method 0.01-6 mg/l as P*	*Standard Method 20th edition 4500 P D* *Check with MWI to standardise the unit of measurement*	*Standard Method 20th edition 4500 P C Vanadomolybd-ophosphoric acid 1-20 mg/l as P*	650	Phosphate - Total as PO4	Water	MG/L
					665	Phosphorus - Total as P	Water	MG/L
					668	Phosphorus - Total Sediment as P	Sediment-Dry	MG/KG
Potassium Streams about av. 2.3 mg/l Groundwater 0.5-10 mg/l	**K^+**	*Flame Photometric Method*	*Standard Method 20th edition 3500 K B*	*Standard Method 20th edition 3500 K B*	935	Potassium - Dissolved	Water	MG/L
					937	Potassium - Total (mg/L)	Water	MG/L
					938	Potassium	Sediment-Dry	MG/KG
					82034	Potassium - Total (ug/L)	Water	UG/L

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			WAJ LABS Units not given	RSS	MWI			
Selenium Streams about 0.2 ug/l Groundwater < 0.1 mg/l	**Se**	*Inductively Coupled Plasma* *Continuous Hydride Generation/Atomic Absorption Spectrometric*	*Standard Method 20th edition* *3120 B* *3114 C*	*Standard Method 20th edition* *3114 C* *(AA Spectrometric Method)*	1145	Selenium - Dissolved	Water	UG/L
					1147	Selenium - Total	Water	UG/L
					1148	Selenium	Sediment-Dry	MG/KG
Silica In Streams & Groundwater about 14 mg/l	**SiO_2**	*Inductively Coupled Plasma*	*Standard Method 20th edition* *3120 B* *Check with MWI to standardise the unit of measurement*		955	Silica - Dissolved	Water	MG/L
					956	Silica - Total	Water	MG/L
					82384	Silica - As SiO2	Water	MG/L
					1142	Silicon - Total	Water	UG/L
Silver Streams about 0.3 ug/l Groundwater < 0.1 ug/l	**Ag**	*Inductively Coupled Plasma* *Direct Air-Acetylene Flame*	*Standard Method 20th edition* *3120 **B*** *3111 B*	*Standard Method 20th edition* *3111 B*	1075	Silver - Dissolved	Water	UG/L
					1077	Silver - Total	Water	UG/L
					1078	Silver	Sediment-Dry	MG/KG
Sodium	**Na^+**	***Flame Emission Photometric Method***	*Standard Method 20th edition* *3500 Na B*	*Standard Method 20th edition* *3500 Na B*	929	Sodium - Total as Na (mg/L)	Water	MG/L
					930	Sodium - Dissolved	Water	MG/L
					931	Sodium Adsorption Ratio	Water	
					934	Sodium	Sediment-Dry	MG/KG
					82035	Sodium - Total as Na (ug/L)	Water	UG/L
Strontium Streams about 50 ug/l Groundwater 0.01-10 mg/l	**Sr**	*Inductively Coupled Plasma*	*Standard Method 20th edition* *3120 B*		1080	Strontium - Dissolved	Water	UG/L
					1082	Strontium - Total	Water	UG/L
					1083	Strontium	Sediment-Dry	MG/KG

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			WAJ LABS Units not given	RSS	MWI			
Sulfate	$SO_4^{=}$	*Ion Chromatography with Chemical Suppression of Eluent Conductivity*	*Standard Method 20th edition 4110 B* *Check with MWI to standardise the unit of measurement*	*Standard Method 20th edition 4110 B*	945	Sulfate - Total as SO4	Water	MG/L
					946	Sulfate - Dissolved as SO4	Water	MG/L
Sulfate (Waste Water)	$SO_4^{=}$	*Turbidimetric Method*	*Standard Method 19 th edition 4500 $SO_4^{=}$ E* *Check with MWI to standardise the unit of measurement*	*Standard Method 20th edition 4110 B*	945	Sulfate - Total as SO4	Water	MG/L
					946	Sulfate - Dissolved as SO4	Water	MG/L
Sulfide (Waste Water)	S^{-2}	*Iodometric Method*	*Standard Method 20th edition 4500 S^{-2} F*	*Standard Method 15 th edition 4500 S^{-2} D Colorimetry*	745	Sulfide - Total	Water	MG/L
					746	Sulfide - Dissolved	Water	MG/L
					740	Sulfite	Water	MG/L
Sulfur	$S^{=}$	*Iodometric Method*	*Standard Method 20th edition 4500-S^{2-} F*			*No MWI parameter code*		
Total Dissolved Solids	**TDS**	*Calculation*	*Standard Method 20th edition 1030 E to calculate TDS from measured EC*	*Standard Method 20th edition 1030 E to calculate TDS from measured EC*	47004	Solids - Total Dissolved (Electric Conductivity)	Water	MG/L
					70304	Solids - Total Dissolved (Conductivity Meter)	Water	MG/L
					70294	Residue - Total Dissolved (Calculated)	Water	MG/L
Total Dissolved Solids	**TDS**	*Dried at 180 C^o Gravimetric Method*	*Standard Method 20th edition 2540 C*	*Standard Method 20th edition 2540 C Dried at 180 C^o Gravimetric Method*	47004	Solids - Total Dissolved (Electric Conductivity)	Water	MG/L
					70304	Solids - Total Dissolved (Conductivity Meter)	Water	MG/L
					70294	Residue - Total Dissolved (Calculated)	Water	MG/L

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			WAJ LABS Units not given	RSS	MWI			
***Total Fixed &Volatile Solids* (Waste Water)**	**T.F&V.S**	*Measured in Solid and Semi- Solid Samples*	*Standard Method 20th edition 2540 G*	*Standard Method 20th edition 2540 E*	*Various parameters listed as solid & residuein mg/l but none according to 2540 G as % solids, % volatile solids, % fixed solids*			
Total Organic Carbon Vital for treatment plants	**TOC**	*Persulfate-Ultraviolet Oxidation*	*Standard Method 20th edition 5310 C*		680	Carbon, organic - Total organic as C	Water	MG/L
					81951	Carbon, organic - Total	Sediment - Dry	MG/KG
Total Solids Dried (Waste Water)	**T.S**	*Dried at 103 to 105 C°* *Material residue left after evaporation (to 105 C°) includes total suspended and dissolved solids*	*Standard Method 20th edition 2540 B*		500	Residue - Total	Water	MG/L
					510	Residue - Total Fixed	Water	MG/L
Total Suspended Solids (Waste Water)	**T.S.S**	*Dried at 103 to 105 C°* Portion of total solids retained by filter	*Standard Method 20th edition 2540 D* *Check with MWI to standardise the unit of measurement Should be at 103 to 105 C°*		70299	Solids - Suspended Residue on Evaporation at 180 C	Water	MG/L
					515	Residue - Total Filtrable	Water	MG/L
					525	Residue - Fixed Filtrable	Water	MG/L
***Solids – Settlable* (Waste Water)**	***Settlable .S***	Material settling out of suspension within a time period (1hr.)	*Standard Method 20th edition 2540 F* *Check with MWI to standardise the unit of measurement*		50086	Solids - Settleable Matter	Water	ML/L/HR
					545	Residue - Settleable	Water	ML/L
					546	Residue - Settleable	Water	MG/L

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Highlighted parameter codes are the recommended units of measurement for data migration

Analysis	Symbol	Method Used	Method No. and Ref.		Parameter Codes for Water Quality Data WIS			
			WAJ LABS Units not given	RSS	MWI			
Trihalomethanes	**T.H.Ms**	*Head Space Analyzer Gas Chromatographic Method*	*WAJ SOP emanated from "British standard 1984-1985"*	*Standard Method 15 th edition 6230 B Water Pollution Analyzer*	82080	Trihalomethanes - Total (by summation)	Water	UG/L
Turbidity	**Turbidity**	*Nephelometric Method*	*Standard Method 20th edition 2130 B*	*Standard Method 20th edition 2130 B*	76	Turbidity - Hach Turbidimeter	Water	HACH FTU
					82078	Turbidity - Field Nephelometric	Water	NTU
					82079	Turbidity - Lab Nephelometric	Water	NTU
					82537	Turbidity - Forward Scatter	Water	JTU
Vanadium	**V**	*Inductively Coupled Plasma*	*Standard Method 20th edition* ***3120 B***	*Standard Method 20th edition 3111 B AA Spectrometric Method*	1085	Vanadium - Dissolved	Water	UG/L
					1087	Vanadium - Total	Water	UG/L
					1088	Vanadium	Sediment-Dry	MG/KG
Volatile Organic Compounds	**VOC**	*Purge and Trap Gas Chromatographic Mass Spectrometric Method*	*Standard Method 20th edition 6200 B*		*Not listed in MWI parameters*			
Zinc Streams about av. 20 ug/l Groundwater <0.1 mg/l	**Zn**	*Inductively Coupled Plasma* *Direct Air-Acetylene Flame*	*Standard Method 20th edition 3120* B *3111 B*	*Standard Method 20th edition 3111 B AA Spectrometric Method*	1090	Zinc - Dissolved	Water	UG/L
					1092	Zinc - Total	Water	UG/L
					1093	Zinc	Sediment-Dry	MG/KG
Total Coliform	**TC**	ost Probable Number MPN) / 100 ml *Membrane Filtration (MF)*	*Standard Method 20th edition 9221 B*	*Standard Method 20th edition 9221 B, C* *9222 B*	31501	Coliform, Total, Membr filter, immed.M-Endo Med, 35C	Water	/100ML
					31502	Coliform, Total 10/ML	Water	10/ML
					31505	Coliform, Total, MPN, confirmed test,35C (tube 31506)	Water	/100ML
					31506	Coliform, Total, MPN, confirmed test, tube config.	Water	TUBECODE
					31508	Coliform, Total, MPN, completed test, tube config.	Water	TUBECODE

Notes: **Abbreviations:** **SM** **Standard Methods** **IPC** **Inductively Coupled Plasma**

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Analysis	Symbol	Method Used	Method No. and Ref.		Parameter Codes for Water Quality Data WIS			
			WAJ LABS Units not given	RSS	MWI			
Fecal Coliform	**FC**	PN / 100 ml (EC medium) ***Actual title of 9221 E is*** *Fecal Coliform Procedure 1. EC medium.*	*Standard Method 20th edition 9221 E*	*Standard Method 20th edition 9221 E multiple tube method*	111	Coliform/Strep ratio, Fecal	Water	
					31621	Coliform, Fecal, A-1 Mod, 44.5C, 24H	Water	MPN
					31625	Coliform, Fecal, MF, M-FC, 0.7 UM (modified to 0.45 UM)	Water	/100 ML
					31612	Coliform, Fecal, 10 ML	Water	10/ML
					31613	Coliform, Fecal. Membr filter,M-FC agar, 44.5C, 24 hr	Water	/100ML
					31615	Coliform, Fecal, MPN,EC MED,44.5C (tube 31614)	Water	/100ML
					31616	Coliform,Fecal, Membr filter,M-FC broth, 44.5C	Water	/100ML
Direct Fecal Coliform	***FC***	PN / 100 ml (A-1 medium) ***Actual title of 9221 E is*** *Fecal Coliform Procedure 2. Fecal Coliform Direct Test (A-1 medium)*	*Standard Method 20th edition 9221 E (3) Check with MWI to standardise the unit of measurement*	*Standard Method 20th edition 9221 E multiple tube method*	31621	Coliform, Fecal, A-1 Mod, 44.5C, 24H	Water	MPN
Chlorophyll-a, b and c **Kinds and quantities of phytoplankton in water**		ectrophotometric Method	*Standard Method 20th edition 10200 H*	*Standard Method 20th edition 10200 H 3* **Only Chlorophyll-a** *Fluorometric Method*	32211	Chlorophyll-a - Spectrophotometric Method	Water	UG/L
Algae Count and Identification		*Concentration by sedimentation Technique*	*Standard Method 20th edition 10200 C in water*	*Standard Method 20th edition 10200 C in water 10200 F in wastewater Counting technique Cell/ml*	46501	Phytoplankton - Total Count / Millilitre	Water	COUNT/ML
Free-Living Organisms (Nematodes) **Nematodes are aquatic animals in water & soil**		*Membrane Filtration Technique*	*American Water Works Association (AWWA)Manual Chapter 5, 1995*	*Test procedure for recovering of Ascaris eggs from sludge WRC process evaluation, Stevenge, UK Water Research Center (1981). Nematode in Sludge*	*Not listed in MWI parameters*			

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Analysis	Symbol	Method Used	Method No. and Ref.		Parameter Codes for Water Quality Data WIS			
			WAJ LABS Units not given	RSS	MWI			
Helminth eggs Count & Identification		*Sedimentation Procedure*	*Method proposed by Prof. J. Schwartzbrod. " Scientific group on Health Aspect for Waste Water" Geneva, 1987*	*WHO- Technical Report (1989) No. 72-P.778 Method A*	*Not listed in MWI parameters*			
Fungi		*Membrane Filtration Technique*	*Standard Method 20th edition 9610 D*	*Standard Method 20th edition 9610 B pour plate 9610 C spread plate 9610 D membrane*				
Pseudomonas aeruginosa		*MPN / 100 ml*	*Standard Method 19 th edition 9213 F*	*Standard Method 20th edition 9213 E Detection & Enumeration*				
Heterotrophic Plate Count		*Pour Plate Method Spread Method Membrane Filtration*	*Standard Method 20th edition 9215 B, C, D*	*Standard Method 20th edition 9215 B, C, D*				
Fecal Streptococcus	***FS***	*MPN / 100 ml*	*Standard Method 20th edition 9230 B*	*Standard Method 20th edition 9230 B 9221 C*				
Clostridium perfringes		*MPN and Most Probable Range (MPR) / 100 ml*	*The Microbiology of Water – Drinking Water – 1994. Report on Public Health and Medical Subject No. 71 London (HMS0)*					
Staphylococcus aureus		*Membrane Filtration*	*HMS0*					
Protozoa:Giardia & Cryptosporidium		*Well Slide Method*	*Modified by Clancey Group from ICR/EPA proposed method Standard Method 19 th edition 9711B &Clancey Protocol*					

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Notes: Standard Methods 20th Edition

Definition: Types of Solids

‘‘**Total solids’’** is the term applied to the material residue left in the vessel after evaporation of a sample and its subsequent drying in an oven at a defined temperature. Total solids includes ‘‘total suspended solids,’’ the portion of total solids retained by a filter, and ‘‘total dissolved solids,’’ the portion that passes through the filter. The type of filter holder, the pore size, porosity, area, and thickness of the filter and the physical nature, particle size, and amount of material deposited on the filter are the principal factors affecting separation of suspended from dissolved solids.

‘‘**Dissolved solids’’** is the portion of solids that passes through a filter of 2.0 mm (or smaller) nominal pore size under specified conditions.

‘‘**Suspended solids’’** is the portion retained on the filter.

‘‘**Fixed solids’’** is the term applied to the residue of total, suspended, or dissolved solids after heating to dryness for a specified time at a specified temperature. The weight loss on ignition is called ‘‘volatile solids.’’ Determinations of fixed and volatile solids do not distinguish precisely between inorganic and organic matter because the loss on ignition is not confined to organic matter. It includes losses due to decomposition or volatilization of some mineral salts. Better characterization of organic matter can be made by such tests as total organic carbon (Section 5310), BOD (Section 5210), and COD (Section 5220).

‘‘**Settleable solids’’** is the term applied to the material settling out of suspension within a defined period. It may include floating material, depending on the technique (Section 2540F.3b).

Liquid-liquid Extraction Gas Chromatographic Method 1 (Section 6630 B)

This gas chromatographic procedure is suitable for quantitative determination of the following specific compounds: BHC, lindane (g-BHC), heptachlor, aldrin, heptachlor epoxide, dieldrin, endrin, captan, DDE, DDD, DDT, methoxychlor, endosulfan, dichloran, mirex, and pentachloronitrobenzene. Under favorable circumstances, strobane, toxaphene, chlordane (tech.), and others also may be determined when relatively high concentrations of these complex mixtures are present and the chromatographic fingerprint is recognizable in packed or capillary column analysis. Trifluralin and certain organophosphorus pesticides, such as parathion, methylparathion, and malathion, which respond to the electron-capture detector, also may be measured. However, the usefulness of the method for organophosphorus or other specific pesticides must be demonstrated before it is applied to sample analysis.